Seminar/Talk

Strange Metals and Entanglement Witnesses

Qimiao Si
Rice University

Host: Kimberly Modic

For quantum materials in the quantum information era, some of the outstanding issues are how to use entanglement means to help advance the quantum materials' understanding and how to identify those with amplified entanglement. Here we focus on strange metals. A notable example occurs in Kondo systems, where the physics of beyond-Landau quantum criticality, through the process of Kondo destruction, results in a complete loss of quasiparticles at the quantum critical point [1]. At this antiferromagnetic quantum critical point, the charge degrees of freedom also exhibit a singular response with dynamical Planckian scaling [2]. This unusual behavior suggests a charge-spin entangled quantum critical fluid, providing direct motivation for using quantum information means to characterize the strange metal state. I will show that the quantum Fisher information reveals amplified multipartite entanglement in the strange metal state [3]. Our theoretical results are supported by experiments in quantum critical heavy fermion metals [3,4]. I will explain how the findings, in addition to pointing to a novel regime of quantum matter for amplified entanglement, shed new light on the nature of the strange metallicity. Further settings for quantum entanglement, particularly cavity-coupled quantum-critical systems as advanced in a very recent study [5], will be discussed. [1] H. Hu, L. Chen & Q. Si, Nat. Phys. 20, 1863 (2024); S. Paschen & Q. Si, Nat. Rev. Phys. 3, 9 (2021); S. Kirchner et al, Rev. Mod. Phys. 92, 011002 (2020); Q. Si et al., Nature 413, 804 (2001).[2] A. Cai et al., Phys. Rev. Lett. 124, 027205 (2020); L. Prochaska et al., Science 367, 285 (2020).[3] Y. Fang et al., Nat. Commun. 16, 2498 (2025).[4] F. Mazza et al., to be published.[5] S. Sur et al., arXiv:2509.26620.

Wednesday, November 12, 2025 11:00am - 12:00pm
Sunstone Bldg / Ground floor / Big Seminar Room A

This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station.
Please find a schedule of the ISTA Shuttle on our webpage:
https://ista.ac.at/en/campus/how-to-get-here/ The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.